PATENT ABSTRACTS OF JAPAN

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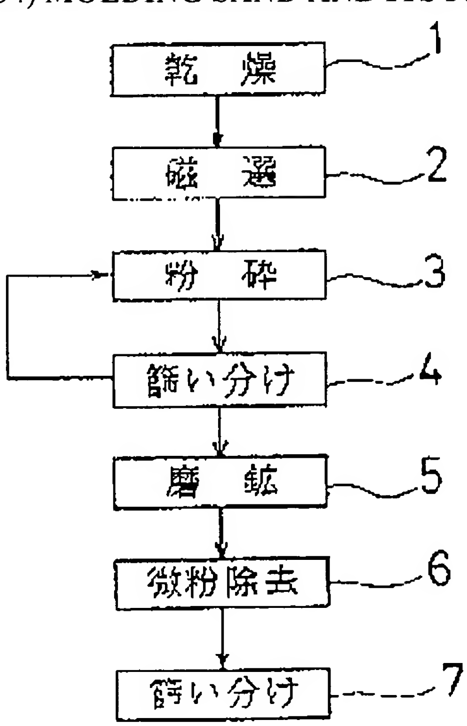
(54) MOLDING SAND AND ITS PRODUCTION



(57)Abstract:
PURPOSE: To effectively utilize slag which is heretofore thrown away as molding sand by separating the slag floating on the molten metal taken out of a tap hole from the molten metal and forming the slag to prescribed grain sizes.
CONSTITUTION: The slag floats on the surface of the molten metal flowing out of the tap hole. This slag is separated and is cooled with water. The water granulated slag is dried to get rid of water and thereafter, the slag is magnetically separated, by which ferromagnetic materials, such as cast iron grains, are removed. The slag past the magnetic sepn. stage is pulverized to about 0.07 to 0.85mm grain sizes. The particle shape of the slag classified to ≤0.85mm by sieving is then approximated to a spherical shape by grinding. Fine powder of ≤0.07mm grain size is removed from the ground slag and the slag is further classified to the prescribed grain sizes and is utilized as molding sand.

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CLAIMS

[Claim(s)]
[Claim 1] Molding sand characterized by fabricating the slag which is floating to the molten metal taken out from the tapping hole of a fusion furnace to a predetermined particle size.
[Claim 2] The manufacture approach of the molding sand characterized by cooling and grinding the slag which is floating to the molten metal taken out from the tapping hole of a fusion furnace after dissociating from the molten metal.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the molding sand used for mold, and its manufacture approach.
[0002]
[Description of the Prior Art] Generally 80% or more of silica sand is used for the molding sand used in case mold is molded conventionally for the content of SiO2. And the organic system resin, for example, the phenol system resin, phenol isocyanate system resin, or furan system resin as a binder is covered to this silica sand, and it is used for shaping of mold. However, the silica sand which uses SiO2 as a principal component carries out thermal expansion about 1 - 2%, when temperature carries out a crystal transformation [it metamorphoses into beta mold (high temperature form) from alpha mold (low temperature form)] near 575 **. Generally the temperature of the mold under casting reaches 500 ** - 700 ** here. Therefore, the mold fabricated from this silica sand will carry out thermal expansion during casting. Especially, in a complicated configuration and the large mold of a thick difference, thermal expansion tends to become an ununiformity and it has serious effect for the quality of a mold crack or a casting. In order to solve these troubles, the porous-ceramics granule with a very small coefficient of thermal expansion or the technique which uses the mixture of this porous-ceramics granule and silica sand as molding sand is indicated by JP,61-245937,A.
[0003]
[Problem(s) to be Solved by the Invention] However, according to the above-mentioned Prior art, in order to obtain a porous-ceramics granule, an impalpable powder particle must be corned and sintered on the basis of severe management. For this reason, compared with the conventional silica sand which sifts out natural sand and is obtained, great costs, an effort, and time amount are required and it is unsuitable as a molding material of a mass-production-method casting. The technical technical problem of this invention tends to manufacture cheaply mold with a small coefficient of thermal expansion by manufacturing good molding sand from the slag generated with a fusion furnace.
[0004]
[Means for Solving the Problem] The above-mentioned technical problem is solved with the molding sand which has the following descriptions. That is, the molding sand concerning claim 1 is characterized by forming in a predetermined particle size the slag which is floating to the molten metal taken out from the tapping hole of a fusion furnace. Moreover, the molding sand concerning claim 1 is manufactured by the manufacture approach of the molding sand shown in claim 2. That is, the manufacture approach of the molding sand concerning claim 2 is characterized by cooling and grinding the slag which is floating to the molten metal taken out from the tapping hole of a fusion furnace, after

dissociating from the molten metal.
[0005]
[Function] According to this invention, molding sand is manufactured from the slag generated with a fusion furnace. Generally the most has vitrified the slag which is floating on the surface of a molten metal here. Therefore, the molding sand manufactured from said slag does not have a crystal transformation near 575 **, and its coefficient of thermal expansion is very small. For this reason, the mold fabricated from the molding sand made from said slag hardly carries out thermal expansion during casting. Consequently, it is hard to generate a mold crack etc., and the quality of a cast product also improves. Moreover, conventionally, said slag is discarded, and since it can reuse this, it can aim at a deployment of a resource. Molding sand can be manufactured still more cheaply.
[0006]
[Example] Hereafter, the manufacture approach of the molding sand applied to one example of this invention with reference to drawing 1 , drawing 2 and Table 1, and Table 2 is explained. This example manufactures molding sand from the slag generated at the cupola furnace used for the dissolution of cast iron. Said cupola furnace is a ** type cylinder-like furnace, and two or more tuyeres which are entrainment opening of hot blast are attached in the furnace body lower part here at the circumferencial direction. And an ingredient (griddle), corks, and a limestone are thrown in from the furnace top section, and, on the other hand, melted iron (molten metal) is taken out from the tapping hole of a bottom section. The slag is floating in the front face of the molten metal which flowed out of said tapping hole. It dissociates with a molten metal near [said] a tapping hole, this slag is led to a predetermined location, and water cooling is carried out here. In addition, the slag (granulated slag) by which water cooling was carried out is because of being cooled and carried with a lot of water. 3 - 10% of moisture is contained. The particle size distribution of this granulated slag (granulated slag former sand) are shown in Table 1.
[0007] Next, how to manufacture molding sand is explained with reference to drawing 1 from said granulated slag. First, as for said granulated slag, the moisture in a slag is removed at the desiccation process 1. Desiccation is performed here using rotary kiln, carrying out rotation of said slag in the ambient atmosphere of the drying temperature of 80 degrees C - 100 **. Usually, the fluid bed method which the compressed air is blown [method] from the lower part of the layer of the molding sand, and makes said molding sand flow is used for desiccation of molding sand. However, since it is difficult to make homogeneity flow by the compressed air since granulated slag has the distribution with a as large particle size as 0.1mm - 10mm as shown in Table 1, especially rotary kiln is used. Next, as for the dried slag, removal of the ferromagnetic in a slag, for example, a cast iron grain, the complex of cast iron and a slag, etc., is performed at the magnetic separation process 2. If a cast iron grain etc. mixes in molding sand, it not only has a bad influence on reinforcement, coefficient of thermal expansion, etc. of mold, but it will become the cause of the surface discontinuity of a cast. For this reason, removal of a cast iron grain etc. is performed out of a slag. As a facility for magnetic separation, an about 1000-5000 gauss magnetic separator is used. With this magnetic separator, adsorption collection is carried out and said cast iron grain etc. is removed out of a slag.
[0008] The slag which passed through the magnetic separation process 2 is ground so that

it may become the particle size of 0.07-0.85mm at the grinding process 3. The impeller breaker with which the grinding yield is high and the particle size after grinding tends to spheroidize as a facility which grinds this slag is used. Said impeller breaker can adjust the particle size of a slag by grinding a slag and controlling the rotational speed of said impeller by flying a slag and making this slag collide with a wall surface with the rotating impeller. The particle size of the slag which passed said impeller breaker is 3.0-0.001mm. Although it has large distribution, a subject is 3.0-0.05mm and it is as follows [this] only several %. However, since the particle size generally used as molding sand is 0.85-0.07mm, as for the slag which had said impeller breaker let it pass, particle size is classified in a thing 0.85mm [or more] and a thing 0.85mm or less at the sieving process 4. Sieving is performed using a level type oscillating sieve. Particle size is returned to the grinding process 3, and a slag 0.85mm or more is again ground by said impeller breaker.
[0009] As for the particle of the slag ground by said impeller breaker, the configuration is a square shape or a point-angle mold. For this reason, temporarily, when this slag is used as molding sand as it was, as compared with conventional silica sand, reinforcement falls by addition of the binder of tales doses, and permeability also gets worse further. For this reason, the processing which brings the configuration of the particle of a slag close to a globular form is needed. At for this reason, said sieving process 4 Next, 0.85mm or less and the classified slag are polished so that the configuration of a particle may be brought close to a globular form with a grinding process 5. In addition, the particle size distribution of the slag which passed through the grinding process 3 and the sieving process 4 are shown in Table 1. A rotary reclaimer is used as a facility which carries out grinding of the particle of said slag. Said rotary reclaimer gives a centrifugal force to the slag which was made to carry out high-speed rotation of the container, and was supplied in the container, makes the particle of the slag accelerated by the particle of the slag deposited in a container collide, and polishes the front face of both slag particles (centrifugal-force rubbing method). By this, the particle of a slag is roundish and the front face of a particle becomes smooth further.
[0010] Since the front face of the grain child to whom grinding processing is given exfoliates, particle size 0.07mm The following fines will be intermingled in a slag. However, particle size 0.07mm The following fines cannot be used as molding sand, in order to worsen the permeability of mold. For this reason, in the following fines removal process 6, particle size the slag which passed through the grinding process 5 0.07mm The following fines are removed. Removal of fines is performed using the fluidized bed classifier which said slag is arranged [classifier] in the shape of a layer, and the compressed air is sent [classifier] in from a lower part, and makes said slag flow. Particle size by this 0.07mm The following fines are blown away by the compressed air and removed out of a slag. In addition, the removed fines are recovered by the dust collector. Although the range of the particle size distribution of the slag (after purification) which passed through the above process is 0.85-0.07mm as shown in Table 1, it is necessary to classify them in some kinds of grain size according to the configuration and the casting surface surface roughness demanded of a cast. For this reason, the slag which passed through the fines removal process 6 is classified in a grain size predetermined at the sieving process 7. And this slag is used as molding sand. In addition, a water flat tip oscillating sieve is used as a facility of sieving.
[0011] Drawing 2 compares the coefficient of thermal expansion of the test piece

fabricated from the molding sand made from granulated slag, and the test piece fabricated from conventional silica sand. Said test piece is molding sand made from granulated slag (100 %) here. What calcinated what did 2 % addition of phenol system resin to the cylindrical shape (28 phix50 L), and silica sand (100 %) What calcinated what did 2 % addition of phenol system resin to the cylindrical shape (28 phix50 L) is used. And they are both test pieces in a 1000-degree C ambient atmosphere 120 Coefficient of thermal expansion is calculated by placing during a second and measuring height change of each cylinder. Here, the coefficient of thermal expansion of the test piece fabricated from the molding sand made from granulated slag is expressed with the continuous line, and the coefficient of thermal expansion of the test piece fabricated from silica sand is expressed with the dotted line. As it does not have a crystal transformation near 575 ** since that most has vitrified said granulated slag, and shown in drawing 2 , the coefficient of thermal expansion of the molding sand manufactured from this granulated slag is very small. Moreover, molding sand made from granulated slag (100 %) The result of the bending test to the piece of shaping which carried out 2 % addition of the phenol system resin, and calcinated it, and silica sand (100 %) The result of the bending test to the piece of shaping which carried out 2 % addition of the phenol system resin, and calcinated it is shown in Table 2. The reinforcement of the piece of shaping calcinated from the molding sand made from granulated slag becomes almost equal to the reinforcement of the piece of shaping calcinated from silica sand as grinding processing is performed and the particle of a slag approaches a globular form. Thus, since the mold fabricated with said molding sand has the reinforcement which is equal to the mold which hardly carried out thermal expansion during casting, and was fabricated with conventional silica sand, the poor quality of a mold crack or a cast product does not generate it. Moreover, conventionally, said slag is discarded, and since it can reuse this, it can aim at a deployment of a resource. Molding sand can be manufactured still more cheaply. In addition, the purification yield at the time of refining the granulated slag after moisture removal at the above-mentioned process was about 85%.

[0012]

表1

粒径　　　（メッシュ）	水滓スラグ元砂	粉砕、篩い分け工程後	精製後
4.76 mm 以上 (4)	0.9 %	−	−
4.76~3.36 (6)	1.3	−	−
3.36~2.38 (8)	6.6	−	−
2.38~1.68 (10)	17.7	−	−
1.68~1.19 (14)	23.5	−	−
1.19~0.84 (20)	23.7	3.9 %	1.4%
0.84~0.59 (28)	13.5	29.1	24.3
0.59~0.42 (35)	6.6	20.8	20.9
0.42~0.29 (48)	2.9	14.6	17.1
0.29~0.21 (65)	1.4	9.9	16.1
0.21~0.15 (100)	0.7	9.1	16.4
0.15~0.11 (150)	0.4	4.2	3.2
0.11~0.07 (200)	0.1	3.5	0.2
0.07~0.05 (270)	−	1.3	−
0.05 mm 以下 (PAN)	−	3.1	−

[0013]
表2

		曲げ強度 N/cm² (Kgf/cm²)
水滓スラグ製 鋳物砂	磨鉱処理1回	353 (36.0)
	磨鉱処理2回	422 (43.0)
珪砂		441 (45.0)

[0014]
[Effect of the Invention] It is hard to generate a mold crack etc., and the quality of mold fabricated with the molding sand concerning this invention of a cast product also improves in order to hardly carry out thermal expansion during casting. Furthermore, since molding sand can be conventionally manufactured from the discarded slag, a deployment of a resource can be aimed at and reduction of cost can be aimed at.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a block diagram showing the process which manufactures molding sand from granulated slag.
[Drawing 2] It is the graph which compared the thermal-expansion situation of the test piece fabricated with conventional silica sand with the thermal-expansion situation of the test piece fabricated with the molding sand obtained from granulated slag.
[Description of Notations]
1 Desiccation Process
2 Magnetic Separation Process
3 Grinding Process
4 Sieving Process
5 Grinding Process
6 Fines Removal Process
7 Sieving Process

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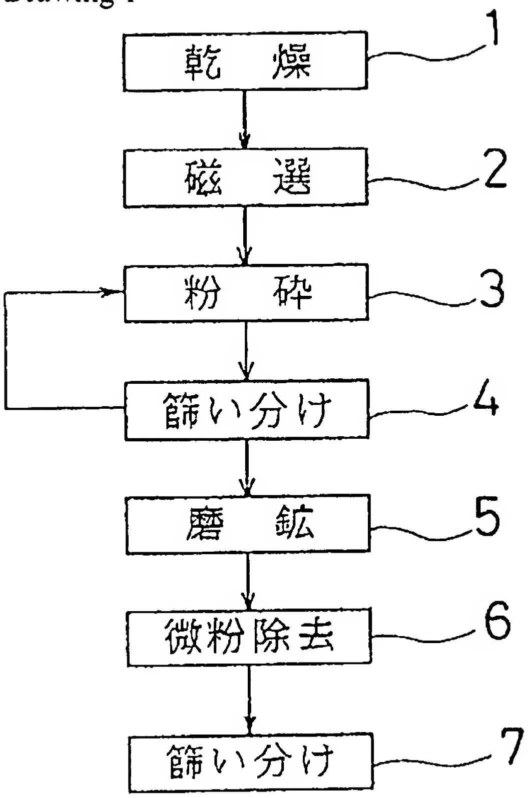
Drawing 1



Drawing 2